WEST

Help Logout Interrupt

Main Menu | Search Form | Posting Counts | Show S Numbers | Edit S Numbers | Preferences | Cases

Search Results -

Terms	Documents
L14 and reference ADJ voltage and (counter or rectifier) and (input or output)	1

10/074,338

Examiner: T. R. Sundaram

Database:
US Patents Full-Text Database
US Pre-Grant Publication Full-Text Database
JPO Abstracts Database
EPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search: L16

Refine Search

Recall Text Clear

Search History

DATE: Friday, December 13, 2002 Printable Copy Create Case

Set Name side by side	**Query**	**Hit Count**	**Set Name** result set
	DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=ADJ		
L16	L14 and reference ADJ voltage and (counter or rectifier) and (input or output)	1	L16
L15	L14 and reference ADJ voltage and counter and rectifier and (input or output)	0	L15
L14	L13 and ((324/$)!.CCLS.)	8	L14
L13	(first or second) with electrode with U-shaped	437	L13
L12	(first or second) with electrode and U-shaped	4048	L12
L11	(first or second) with electrode and U-shaped 40725	0	L11
L10	(first or second) with electrode with U-shaped 40725	0	L10
L9	L8 and reference ADJ voltage and counter and rectifier and (input or output)	2	L9
L8	L7 and ((324/$)!.CCLS.)	219	L8
L7	(first or second) with electrode with (wrap$4 or U-shaped or encircl$4 or surround$3)	5866	L7
L6	L5 and counter	19	L6
L5	L4 and (input or output)	66	L5
L4	L3 and rectifier	69	L4
L3	L2 and reference with voltage	417	L3
L2	L1 and ((324/$)!.CCLS.)	1464	L2
L1	(first or second) with electrode and (wrap$4 or U-shaped or encircl$4 or surround$3)	40725	L1

END OF SEARCH HISTORY

WEST

Generate Collection Print

Search Results - Record(s) 1 through 2 of 2 returned.

☐ 1. Document ID: US 6133743 A

L9: Entry 1 of 2 File: USPT Oct 17, 2000

DOCUMENT-IDENTIFIER: US 6133743 A
TITLE: Method and device for determining the respective geometrical position of a body by capactive sensing

Brief Summary Text (6):
The capacitive displacement sensor described by DE 28 26 398 C2 comprises a pair of obliquely divided, mutually insulated capacitor plates to which an alternating voltage is applied and between which an intermediate plate, serving as a pick-off being adjustable by the length of the path to be picked off, is arranged and connected to the input of an evaluation circuit via a connection cable. The movements of the pick-off lead to constantly varying forces acting on the connection cable and its connection points; these forces not only result in accelerated aging of the displacement sensor, but have the additional effect, especially due to the changes in the position and displacement of the cable, to cause capacitance variations and varying stray capacitances as well as varying leakage resistances, which constitute a disturbance variable that cannot be specified and, above all, that cannot be compensated in this way.

Brief Summary Text (7):
The evaluation circuit of this known displacement sensor comprises an operational amplifier whose one input is connected via the connection cable to the displaceable intermediate plate, which latter serves as pick-off, and to whose other input the feed-back measuring signal is applied via a resistor connected to ground. The output of the operational amplifier is connected, via a rectifier, to other amplifier elements one of which is configured as an emitter follower. As in such evaluation circuits the arising stray capacitances are in the order of the measuring capacitance, and the input resistance of the amplifier is in the range of the sensor impedance, for usual frequencies, a precise and strictly linear output voltage cannot be expected.

Brief Summary Text (13):
The invention does not need any costly screening for this purpose as it succeeds in compensating the influence of stray capacitances to ground, and the input resistance of the circuit, by the automatic control of the overall gain and/or the supply of the voltage divider circuit, which preferably is a usual resistance path of the type also used in potentiometer-type displacement sensors. The automatic control is effected in connection with, and altogether tuned to, switching actions performed at different points of the evaluation circuit.

Brief Summary Text (14):
Thus, a first preferred embodiment of the invention is based on an arrangement which differentiates between two phases, by timed interruption of connection lines between the signal source supplying the resistance path, and the resistance path, namely a first phase I in which the full voltage then present over the full length of the resistance path--regardless of the position of the capacitive potential probe scanning its voltage distribution pattern--is picked up by that probe and compared with a reference voltage, and a second measuring phase in which the obtained measured value can be evaluated. During phase I the amplification gain of the measured value, that has been picked up capacitively by the potential probe, is correspondingly balanced and/or the signal source feeding the resistance path at a controllable amplitude is influenced in such a way that any variations occurring during the measuring phase II, when one end of the resistance path is again supplied with the control voltage, are exclusively due

to the respective position of the potential probe, based on its displacement, while any other influences due to stray capacitances or leakage resistances are eliminated because they have been compensated before by the change in gain during phase I, i.e. the phase of comparison with the reference voltage. It is of course a precondition for this system that the circuitry components involved show a linear behavior, which condition is fulfilled in the present case.

Brief Summary Text (16):
According to another embodiment of the invention it is further possible to supply the voltage divider with an alternating voltage in such a way that, alternately, one end is connected to an alternating voltage, while the other end is connected to ground. This has the effect that the voltage appearing at the output represents alternately the voltage divider ratio or its difference to one. When the gain is then controlled in such a way that the sum of those values corresponds to the reference voltage, then one obtains two oppositely directed output voltages representative of the voltage divider ratio, i.e. the desired measured value, and the reference voltage. respectively.

Detailed Description Text (9):
The respective surfaces of the potential measuring probe 15 and the potential coupling probe 17 form together with the respective counter-surfaces of the resistance path and the electrode 16, respectively, capacitors that are designated, in the subsequent evaluation circuits, as measuring capacitor C.sub.M and/or as coupling capacitor C.sub.K respectively, and whose capacitance remains almost unchanged across the displacement path so that the generation of the measured value is not influenced by capacitance variations.

Detailed Description Text (10):
Thus, the potential coupling probe 17 transmits the alternating-current voltage amplitude-measuring signal tapped at the potential measuring probe 15 capacitively and correctly to the electrode surface 16 of the potential coupling area 12, there being only one additional connection 16a which does not change its position and at which the voltage amplitude signal reaches the input 18 of the supply/evaluation circuit 14.

Detailed Description Text (31):
A first embodiment of one evaluation circuit is illustrated in FIG. 4. The resistance path 20 is connected to an alternating voltage supply source 21 which has one end connected to ground 22. The potential probe forms together with the respective associated part of the resistance path 20 a first measuring capacitor C.sub.M connected in series with the coupling capacitor C.sub.K. The circuit diagram of FIG. 4 further shows stray capacitors C.sub.S connected to ground and the resistance path, respectively, or other supply lines, together with an input capacitor C.sub.E and an input resistor R.sub.E at the input of a controllable-gain amplifier 23, all of which make themselves likewise felt as disturbance variables.

Detailed Description Text (32):
The output of the amplifier is connected in parallel--via switches S1, S2, provided in push-pull arrangement, which may of course also take the form of electronic switches--to a first rectifier 24 whose output is connected to a controller 25 (for example an operational amplifier), the other input of which is supplied with a reference voltage U.sub.ref. In addition, a storage capacitor 26 is provided at the input of the controller 25 for the intermediate storage of the rectifier output signal.

Detailed Description Text (33):
The output of the controller is connected to the controllable-gain amplifier 23 and may optionally also act (alone or in combination with some action on the amplifier 23) on the alternating voltage supply source 21 so that the latter constitutes a signal source with controllable amplitude.

Detailed Description Text (34):
A parallel output branch also comprises a second rectifier 27, connected in series with a low-pass filter 28, if desired, to whose output the measuring signal (U.sub.A) is applied; the switches S1 and S2 are synchronously connected to a switch S3 connected into the supply line to the resistance path 20 in a manner such that the switching conditions illustrated in FIG. 4 alternate, which means that the switch S3 is open every time the switch Si is closed, and vice versa; the switch S2, which connects the measured-value processing elements to the output of the amplifier 23, is closed when the alternating supply voltage is supplied also to the resistance path 20, with the switch S3 in the closed and the switch S1 in the open condition, so that no

amplification variations or variations in the amplitude of the supply voltage occur at that point in time or during that working phase.

Detailed Description Text (35):
The basic function of such a circuit arrangement, which is capable of being varied in a plurality of ways, is then as follows: During a first phase, when the switch S3 is open, the switch S2 is open, too, while the switch S2 is closed--the respective activation being taken care of by the logic and control circuit 29--, the voltage divider is supplied by the alternating voltage supply source 21 in such a way that both ends exhibit the same potential, since with the switch S3 in its open condition no voltage drop occurs across the resistance path, irrespective of the position occupied at that time by the potential measuring probe. Consequently, the potential measuring probe senses the same potential at each position, which after having being amplified by the amplifier 23 and rectified at the input of the controller 25--the latter being preferably an I controller--is then compared with the reference voltage. The I controller 25 then re-adjusts the gain of the amplifier 23 (or influences the amplitude of the alternating voltage supply source 21, which is controllable in this case) to ensure that an output voltage corresponding to the reference voltage U.sub.ref appears at the output of the first rectifier 24, or at the inlet of the I controller 25 which latter is finally connected to the amplifier 23--this of course during the comparison phase during which the output voltage of the measuring probe is independent of the latter's position. At the same time, this signal sensed by the potential measuring probe during the comparison phase provides a measure for the transmission from the resistance path 20 to the measuring probe and, generally, for the transmission ratio achieved by the evaluation circuit. However, since the operation of the system is linear, this transmission ratio also applies to partial voltages, i.e. at times when the resistance path 20 effectively operates as a voltage divider.

Detailed Description Text (37):
During the measuring phase the derived signal is rectified by the second rectifier 27, with the switch S2 closed, and transmitted via a low-pass filter 28 to the measuring output where due to the fact that the gain has been adjusted in such a way that a signal corresponding to the reference voltage U.sub.ref will appear under full voltage conditions, the signal appearing is proportional to the voltage divider ratio, i.e. representative of the position of the measuring probe.

Detailed Description Text (39):
During the first comparison phase I, when no voltage drop occurs, the probe voltage Us sensed by the probe 32 is transmitted, after having been amplified by the (controllable) amplifier 33 and rectified by the first synchronous rectifier 34, reaches the summation point 36 as direct voltage Ugv, at which point the difference to the reference voltage U.sub.ref supplied is derived. The differential direct voltage is then transmitted to the subsequent controller 37, whose output is either applied--as mentioned before--to the input of the amplifier 33, for adjusting its gain, or is used--alternatively--for adjusting the amplitudes of the voltages Uv1 and Uv2 supplied by the alternating voltage generator 38.

Detailed Description Text (40):
Here again, the measured output voltage U.sub.A, representative of the particular position of the probe, is transmitted during the measuring phase to the measuring output via the second synchronous rectifier 35. Given the fact that the gain and/or the supply voltages of the potentiometer path had been adjusted during the comparison phase in such a way that a signal corresponding to the reference voltage appears under full voltage conditions, the output voltage U.sub.A will be proportional to the voltage divider ratio and the reference voltage.

Detailed Description Text (42):
Due to the shift in phase of the two supply voltages Uv1' and Uv2' generated by the alternating-voltage generator 38, the resistance path 20' is supplied with voltages of alternately the same and opposite phase, the voltage Uv2' lagging behind the voltage Uv1' by one fourth of a period. Consequently, during the periods of time designated by V, the two supply voltages have the same, either positive or negative, direction while during the periods of time designated by M they are in phase opposition. Consequently, no voltage drop occurs at the voltage divider during the "equal phase" periods V, and the electronic switch and the first synchronous rectifier 34 produce during that period the reference voltage Ugv which corresponds to the potential probe voltage Us during that time. During the periods of time M, the opposite-phase supply voltages produce a voltage drop across the resistance path 20', which is used for determining the "voltage divider ratio", i.e. the position of the potential probe (measuring phase II). The

measuring voltage Ugm is likewise produced by means of the electronically controlled circuit and second synchronous rectifier 35, the two values Ugv and Ugm being stored in corresponding circuits that are implemented in the form of capacitors 26, 26'. The diagram of FIG. 7 reflects the potential curves for three different potential probe positions, namely one near the connection for a supply voltage Uv1, one approximately at the middle of the resistance path, and one near the end of the voltage supply point for Uv2.

Detailed Description Text (44):
Another way to implement the system is that represented by FIG. 4, where the resistance path 20' of the voltage divider element is supplied with alternating supply voltages in phase opposition, which means in other words that a rising and a dropping characteristic is produced, as represented in FIG. 9, by changing the polarity of the potentiometer path. In this case (see FIG. 8) the alternating voltage source 38' supplies alternating supply voltages Uv1 and Uv2 of equal amplitude, that are alternately applied to the ends of the resistance path 20' via first electronic switches 45 and 48, while at any time the respective other end of the resistance path 20' is connected to ground via further electronic switches 46 and 47. Consequently, the switches 45 and 47 are activated in combination with the controlled amplifier circuit 35, while alternately, during a next phase, the switches 46 and 48 are activated in combination with the controlled rectifier circuit 34--although no separate comparison and measuring phases exist in the case of this embodiment of the invention.

Detailed Description Text (45):
The output signals of the two rectifiers 34 and 35, which are controlled in synchronism with the switches 45 to 48, are intermediately stored in the capacitors 26 and 26', and are then transmitted via a summing element 36' to the controller circuit 37' which latter its configured as I controller preferably to control, here again, the input amplitude of the supply voltages Uv1, Uv2 to the resistance potentiometer path in such a way that the sum of the two output voltages determined remains constant, i.e. that--according to the representation of FIG. 9--the voltage sum is, for example, adjusted to a higher value by comparison with a constant value, as the sum of the two characteristic curves 1 and 2 must have a constant value at any position of the path. In the case of the embodiment of FIG.

Detailed Description Text (46):
8, this can again be achieved by effecting a comparison with a reference voltage U.sub.ref supplied to the summing element 36' The controller then ensures that the sum of the two output signals is equal to the reference voltage U.sub.ref, either by adjustment of the gain of the amplifier 33 or by corresponding re-adjustment of the amplitude of the supply voltage for the potentiometer, as indicated by the dashed connection line between the output of the I controller 37' and the input of the alternating-current generator 38'.

Detailed Description Text (47):
Such a control also has the effect to eliminate the influence of any disturbance variables due to the properties of the coupling capacitors, it being possible in this case to use the signal of either the one or the other characteristic, i.e. Uan or Uap, as output voltage.

Detailed Description Text (48):
It has been found to be desirable in the case of such a capacitance-based displacement sensor, angle or position sensor that the voltage source supplying the voltage divider, and the amplifier input for the output voltage should have a defined potential reference point as otherwise the measurement may become dependent on the potential ratio in the supply voltage and of the sensor housing. It is, therefore, desirable that the ground potential of the supply voltage be connected to the sensor housing, at least for the frequency range used, as otherwise undefined conditions may arise in which case measuring errors cannot be excluded.

Detailed Description Text (51):
The diagram of FIG. 10 shows the voltage divider element 13 as potentiometer resistance path, the coupling electrode 16 with the common element consisting of the potential measuring probe 17 and the potential coupling probe 15, the amplifier 33', and a first component 41 comprising those components that are shown by dash-dotted lines in FIG. 8, and further a second component 42 comprising the components that are surrounded by dashed lines in FIG. 8.

Detailed Description Text (57):

Another aspect of the present invention is the necessity to monitor certain parts of the circuit or the overall function in order to avoid that any failure of the sensor, that may remain unnoticed, may cause greater damage. It would, therefore, be convenient to provide a higher-level circuit, preferably one designed as a microprocessor having a plurality of inputs, that may be connected to different circuit points of the respective embodiments discussed in connection with the Figures, and that initiates an alarm or some other measure when certain predetermined threshold values are exceeded in upward or downward direction.

Detailed Description Text (58):
In addition to failures of the electronic systems, breakage of the supply line to the sensor, short-circuits of the sensor connections, short-circuits of the measuring electrode and the output voltage have to be considered as possible failure conditions.

Detailed Description Text (59):
In addition to monitoring the output voltage to ensure that it remains within plausible limits, the proper function of the system can be actively verified by other circuit details, namely:

Detailed Description Text (60):
Monitoring the operational gain for the re-adjustment of the reference voltage;

Detailed Description Text (61):
In addition, to ensure the proper function of the sensor, a minimum and a maximum output signal of a measuring probe must appear so that the control voltage (if a controllable amplifier is provided) or supply voltage for the voltage divider can be monitored;

Detailed Description Text (62):
Monitoring the reference comparison, for example by varying the rectification by means of control inputs in such a way that, as long as the system functions properly, the reference voltage appears at the output;

Detailed Description Text (63):
Monitoring the reference potential, for example by controlling the rectification in such a way that a potential near the reference potential appears at the output;

Detailed Description Text (64):
Monitoring the opposite-phase output voltage; here again, the rectification may be controlled in such a way that the output voltage assumes a value as if the two connections of the voltage divider had been exchanged.

Current US Original Classification (1):
324/683

Current US Cross Reference Classification (1):
324/660

Current US Cross Reference Classification (2):
324/686

CLAIMS:

1. A method for determining a location of a measuring probe by capacitive sensing, comprising the steps of:

guiding the measuring probe along and in spaced relation to a voltage distribution element to a position between first and second ends of the voltage distribution element, the voltage distribution element being connectable to a voltage supply source which supplies an alternating voltage, and the measuring probe being capacitively coupled to the voltage distribution element to sense a voltage therebetween through said capacitive coupling;

applying the alternating voltage to the first end of the voltage distribution element while the second end is connected to ground and capacitively sensing a first sensed voltage at the position of the measuring probe, and then applying the alternating voltage to the second end while the first end is connected to ground and capacitively sensing a second sensed voltage at the position of the measuring probe;

summing the magnitudes of the first and second sensed voltages;

comparing the summed voltage magnitudes to the magnitude of a reference voltage value; and

controlling the magnitude of one of the alternating voltage and a controllable gain amplifier to make the magnitude of the summed voltage equal to the magnitude of the reference voltage value,

whereby the location of the measuring probe relative to the first end of the voltage distribution element is represented by the voltage divided ratio of the first sensed voltage to the reference voltage value, and the location of the measuring probe relative to the second end of the voltage distribution element is represented by the voltage divided ratio of the second sensed voltage to the reference voltage value.

☐ 2. Document ID: US 5077635 A

L9: Entry 2 of 2 File: USPT Dec 31, 1991

DOCUMENT-IDENTIFIER: US 5077635 A
TITLE: Capacitive position sensor

Brief Summary Text (10):
Another object of the invention is to provide such an improved position sensing device whose output is substantially independent of temperature fluctuations and vibration loads.

Brief Summary Text (11):
In keeping with these objects and with others, which will become apparent hereafter, one feature of the invention resides in the provision of a capacitive position sensor, preferably an angular position sensor for determining position of a throttle valve in an internal combustion engine, which includes a capacitor arrangement assembled of two opposite electrode structures which are movable relative to each other such that the capacitance value of the arrangement depends on the mutual position of the structures; one of the electrode structures includes three electrode sections and the other electrode structure includes a counterlectrode section; a first electrode section of the one structure is connected to a source of a first a.c. voltage (u1) and a second electrode section is connected to a source of a second a.c. voltage (u2) having opposite phase than the first a.c. voltage; a third a.c. voltage (uR) delivered by electronic regulating means which are connected to the counterelectrode section; the regulating means adjust the magnitude and phase of the third a.c. voltage (uR) to a value at which an a.c. voltage, electrostatically induced at the counterelectrode section by the combined effect of the first, second and third a.c. voltages on the respective electrode sections, is neutralized to zero. The adjusted magnitude and phase value of the third a.c. voltage (uR) is converted into a d.c. reference voltage which serves as a measure of the relative position of the two movable electrode structures.

Brief Summary Text (13):
The counterlectrode section partially overlaps the first and second electrode sections in such a manner that with a position change between the two electrode structures, the active capacitor area between the first electrode section and the counterelectrode section diminishes (or increases) to the extent as increases (or diminishes) the active capacitor area between the second electrode section and the counter-electrode section. The induced voltage at the counter-electrode section changes accordingly.

Brief Summary Text (20):
The circuit arrangement of the electronic control means for detecting relative position

of the capacitor arrangement and for delivering a corresponding measuring signal is electrically connected with the counterelectrode sector by means of a flexible electrical line which applies the potential of the counterelectrode to an input of the electronic regulating means.

Brief Summary Text (21):
In a modification, it is also possible to provide one of the electrode structures with a fifth electrode facing the counterelectrode sector in any position of the movable electrode structure whereby a.c. voltage induced by the counterelectrode on the fifth electrode is a measure of the charge condition of the counterelectrode. Therefore, the movable part of the capacitor arrangement needs no electro-mechanical contact between the counterelectrode and the input of the electronic control circuit. To that extent it is advantageous to provide the first, second, third and fifth electrodes on a stationary part or stator whereas the counter-electrode and the fourth electrode sector are arranged on a movable part or rotor.

Brief Summary Text (24):
It is of a particular advantage when voltages included at the counterelectrode or at the fifth electrode are rectified by means of a synchronized rectifier, whereby deviation from a desired zero potential at the counter-electrode is integrated in an operational amplifier connected as an integrator, and the integrated d.c. voltage at the output of the integrator is converted by means of a synchronous d.c./a.c. voltage changer into an a.c. regulating voltage which is applied to the third electrode section as the third a.c. voltage. The output d.c. voltage of the integrator is a measure of the relative position of the parts of the capacitor arrangement.

Detailed Description Text (8):
For the sake of clarity, the rotor 6 of the capacitor arrangement 2 in FIG. 1 is illustrated beside the stator 5. Actually, as seen in FIG. 2, the rotor 6 concentrically faces the stator 5 such that the opposite surfaces of the plates 11 and 13 extend parallel to each other. The rotor plate 11 supports a counterelectrode 25 in the form of a circle sector of about 240.degree.. The circular outer rim 26 of the counterelectrode 25 is surrounded by an electrode strip 28 which is integral with a fourth electrode 29 having the form of a circle sector of about 120.degree.. The electrode strip 28 and the fourth electrode 29 are separated from the counter-electrode 25 by an isolating zone 27.

Detailed Description Text (9):
The rotor 6 is pivotable relative to the stator 5 within an angle range .alpha. of .+-.60.degree. (a measuring range). The position of the rotor 6 as illustrated in FIG. 1 corresponds to a starting or "0" position wherein the counter-electrode 25 overlaps half areas of the first and second electrode 21 and 22. The entire area of the third electrode 23 is always overlapped by the counterelectrode 25 in any angular position within the measuring range (.+-.60.degree.).

Detailed Description Text (10):
The regulating and evaluating circuit in the embodiment of FIG. 1 includes an oscillator 30 which delivers at its outputs 31 and 32 two a.c. voltages u1 and u2 having the same amplitude at opposite phase. The first a.c. voltage u1 is applied to the first electrode sector 21 and the second a.c. voltage u2 is applied to the second electrode sector 22. The time course of the two voltages is illustrated in the upper half of the plot diagram of FIG. 3. The voltages u1 and u2 have a rectangular waveshape with an equal maximum amplitude U.sub.B. The regulating circuit includes an operational amplifier 33 whose plus-input is connected to ground 34. The minus-input of the amplifier is connected with the counter-electrode 25. The output 35 of the amplifier 33 is connected to the third electrode sector 23 and to a contact of an electronic switch 36 which is operated in synchronism with the second a.c. voltage u2. In the feedback branch between the minus-input and the output 35 of the amplifier 33, there is connected an RC-network 37 consisting of a series connection of resistors 38, 39 and a capacitor 40 connected between the junction point of the two resistors and the ground. The fourth electrode sector 29 on the rotor 6 is also connected to the ground 34. The other contact of switch 36 is connected via a resistor 41 to the plus-input of another operational amplifier 41. A capacitor 42 connects the plus-input to ground 34. The output 42' of the amplifier 41 is connected via a series connection of resistors 43 and 44 to ground. The resistor 43 is a potentiometer whose sliding arm is connected to the minus-input of the amplifier 41. A signal U.sub.A at the output 42' of the operational amplifier 44 is a measure of the relative angular position between the stator 5 and the rotor 6.

Detailed Description Text (21):
The regulating and evaluating circuit of FIG. 1 converts the ratio c(.alpha.) into an analog d.c. voltage U.sub.A at the output 42' of the operational amplifier 41. The voltage U.sub.A represents a measure of the sensed angular position. It is evident that the capacity CR is present in the feedback branch of the operational amplifier 33. Since the amplifier 33 exhibits a large voltage amplification, the feedback has the effect that the a.c. voltage induced at the counterelectrode by a.c. voltages at the stationary electrode sectors 21-23, is practically reduced to zero ("0") value. Capacities formed between the counterelectrode 25 and the facing parts of the housing 7 or a grounded backside coating of the rotor 6, have no significant effect on the result of measurement.

Detailed Description Text (25):
Due to the d.c. feedback (network 37) and the connection of the plus-input of the amplifier 33 with ground 34 the d.c. component UR =0, only the rectangular a.c voltage uR appears at the output of the amplifier 33.

Detailed Description Text (28):
The capacitor 42 is connected with the plus-input of the operational amplifier 41. The amplifier 41 operates as a loadable driver for the signal at the output 42' . By means of resistors 43 and 44, the amplification factor v of amplifier 41 is adjustable, thus enabling a calibration of the scale factor for the angle-to-voltage conversion. For, the output voltage UA at the output 42', the following relation is valid:

Detailed Description Text (33):
The oscillator 30 is constructed as an astable multivibrator whose frequency is set by an external network 46. Apart from the mutually inverted rectangular output voltages u1 and u2, the oscillator 30 delivers a rectangular voltage u0 at a doubled frequency, as shown in the time diagram of FIG. 5. By means of a network 37, the operational amplifier 33 is provided with a negative d.c. feedback for stabilizing operating point of the amplifier. For an a.c. feedback serves the capacity CR between the stator 5 and the rotor 6 of the capacitor arrangement 2. At the output of the operational amplifier 33, an approximately rectangular voltage uR is generated.

Detailed Description Text (35):
wherein k.apprxeq.0.5. The voltage UT is applied to the plus-input of the operational amplifier 41. By means of the electronic switch 47 the voltage uR is scanned during the second half of the negative half-wave of u1 and applied via a resistor 41 (load resistor) to the load capacitor 42. The scanning is performed by a switching element 48 of the electronic switch 47.

Detailed Description Text (37):
The operational amplifier 41 is wired such as to produce at its output 42' the output voltage

Detailed Description Text (38):
whereby the amplification factor v is adjustable by means of a voltage divider 51. The voltage divider 51 is formed by a series connection of resistors 52, 53 and 54 connected between the center point M of voltage divider 45 and the output 42' of the operational amplifier 41. The resistor 53 is a potentiometer whose sliding arm is connected to the minus-input of the operational amplifier 41. With the aid of the potentiometer 53, effects of manufacturing tolerances can be corrected by adjusting the steepness of the characteristic line of the position sensor.

Detailed Description Text (39):
In the embodiments of FIGS. 1 and 4 both the stator 5 and the rotor 6 have an active diameter of 40 mm; the air gap d between the electrode structures amounts to 0.8 mm; and the frequency of oscillator 30 is 25 kHz. Upon adjusting the aforementioned steepness of the sensor, the zero point of the angle scale can be redefined such that for example at a new angle .alpha.'=0 the output voltage UA equals 0. The characteristic line of the resulting angle-to-voltage converter is represented for example by the equation

Detailed Description Text (43):
FIG. 7 illustrates still another embodiment of the capacitive position sensor of the invention wherein components parts described in preceding examples are designated by like reference numerals. By contrast to the embodiment of FIG. 1, the central region of the stator 5 is provided with a fifth electrode 58 having a circular surface 59 facing a corresponding circular surface portion 60 of the counterelectrode 25 on the rotor 6.

The rim 61 of the central circular surface portion 60 of the counterelectrode coincides with the rim 62 of the circular fifth electrode 58 on the stator. The first, second and third electrode segments on the stator surround the circular fifth electrode 58 and the inner contour of the fourth electrode 29 on the rotor 6 matches the flanks and the circular rim 61 of the counterelectrode 25.

Detailed Description Text (44):
The regulating and evaluating circuit in the embodiment of FIG. 7 is provided with an impedance converter 63 including an operational amplifier 64. The plus-input of the amplifier 64 is connected with the circular fifth electrode 58 and is also connected to ground 34 via a voltage divider 65 formed by resistors 66 and 67. A capacitor 68 is connected between the connection point of the resistors 66 and 67 and the minus-input of the amplifier 64. The minus-input is directly connected to the output 69 of amplifier 64. The output 69 is connected via a capacitor 70 to a switching contact of a two-position switch 71. In one position of the switch 71, the capacitor 70 is connected via a resistor 73 to a grounded plus-input of an operation amplifier 72 whereas in the other position, the capacitor 70 is connected via a resistor 72' to the minus-input of the amplifier 72. The output 73 of the amplifier 72 delivers an output voltage UA1 and is connected via a capacitor 74 with the connection point of the resistor 72' and the minus-input. The output 73 is also connected to a contact of a further two-position switch 75 which is actuated in synchronism with the switch 71 and operates as a d.c. voltage to a.c. voltage changer. The actuation of the switches 71 and 75 takes place in dependency on the first a.c. voltage u1, as indicated by the dashed line 76.

Detailed Description Text (45):
The output 73 is further connected via a resistor 77 with the minus-input of an operational amplifier 78, whose plus-input is connected to ground 34. A series connection of a fixed resistor 81' and a trimmer resistor 82 is connected between the output 79 and the minus-input of the amplifier 78. The output 79 delivers an output voltage UA2 and is connected to a second contact of the switch 75. The switching arm of the switch 75 is connected with the third electrode segment 23.

Detailed Description Text (47):
The a.c. voltages u1 and u2 on the electrode segments 21 and 22 electrostatically induce an a.c. voltage ui on the counterelectrode 25. Due to the variable overlapping of the electrode segments 21 and 22 by the counterelectrode 25, the a.c. voltage ui is a function of the angle of rotation .alpha.. The a.c. voltage ui in turn induces a proportional a.c. voltage uW on the fifth circular electrode 58. The operational amplifier 68 due to its boot-strap wiring serves as an impedance converter 63 for the voltage source constituted by the capacitor arrangement 2. The impedance converter 63 has a large capacitive inner resistance. The before described two-position electronic switch 71 which is operated by the first a.c. voltage u1 to act as a synchronized rectifier, connects the output 69 of the impedance converter 63 alternately with the inputs of the operational amplifier 72 which is wired to operate as an integrator 81. The integrator is supplied with the synchronized a.c. voltage uW from the fifth circular electrode only during a halfwave. At a positive angle .alpha. the d.c. output voltage UA1 of the integrator 81 grows stepwise in the negative direction whereas at a negative angle .alpha. it grows in the positive direction. The output voltage UA1 of the integrator 81 is inverted by means of operational amplifier 78 which is wired as an inverter 82. Therefore, the following equation is valid:

Detailed Description Text (49):
The integrator 81 and the inverter 82 are active so long until the a.c. voltage uW =0 and the induced neutralizing voltage ui also drops to zero. At the end of the regulating process the d.c. output voltage UA1 is a measure of the angle of rotation .alpha.. The embodiment of FIG. 7 in comparison with the embodiments of FIGS. 1 and 4 has the advantage that mechanical contacts, such as the contact pin 16 and the flexible conductor 19 between the rotor 6 and the electronic parts, can be dispensed with.

Detailed Description Paragraph Table (1):
a variable capacity C1 formed by the overlapped areas of the electrode sector 21 and the counter- electrode 25; a variable capacity C2 formed by the overlapped areas of the electrode sector 22 and the counter- electrode 25; a fixed capacity CR formed by continuously overlapped areas of the counterelectrode 25 and the third electrode sector 23.

Current US Cross Reference Classification (2):
324/725

CLAIMS:

1. A capacitive position sensor, particularly an angular position sensor for use in connection with a throttle valve of an internal combustion engine, comprising

a capacitor arrangement (2) having two facing electrode structures (3, 4) supported for movement relative to each other, one of said electrode structures including at least three coplanar electrodes (21, 22, 23) and the other electrode structure including at least a planar counter-electrode (25);

means for applying a first a.c. voltage (u1) to a first electrode (21), and a second a.c. voltage (u2) of equal amplitude and of opposite phase to a second electrode (22) of said one electrode structure;

regulating means for applying a third a.c. voltage (uR) to a third electrode (23) of said one electrode structure, said regulating means being coupled to said counterelectrode (25) of the other electrode structure to regulate said third a.c. voltage (uR) to an amplitude and phase value at which an a.c. voltage which has been induced by said first, second and third electrodes (21, 22, 23) on said counterelectrode (25), is neutralized to zero; and

means for converting the neutralizing value of said third a.c. voltage (uR) into a d.c. voltage value (UA) serving as a measure of the relative position of said movable electrode structures (3, 4).

4. A position sensor as defined in claim 3, wherein the value of said induced a.c. voltage on said counter-electrode depends on the position of said first and second electrodes (21, 22) relative to said counterelectrode.

15. A position sensor as defined in claim 14, wherein said fifth electrode is a circular electrode concentrically arranged on said stator, and said first, second and third electrodes having the shape of an annular segment surrounding said fifth electrode.

17. A position sensor as defined in claim 16, wherein said converting means includes an integrator (81) coupled via a synchronized rectifier (71) to said fifth electrode to deliver at its output an integrated d.c. voltage (UA1); said regulating means including an inverter (78) for inverting said integrated d.c. voltage (UA1) at the output of said integrator and a synchronized d.c. voltage-to-a.c. voltage changer (75) for converting the integrated d.c. voltage (UA1) into the third a.c. voltage (uR) and applying the same to said third electrode (23) until the induced a.c. voltage on said counterelectrode is neutralized to zero where-upon said integrated d.c. voltage (UA1) represents a measure of the position of said rotor.

18. A position sensor as defined in claim 17, wherein said synchronized rectifier includes a first electronic two-position switch, said integrator including a first operational amplifier having a plus-input connected to one contact of said first switch and a minus-input connected to the other contact of said first switch, said inverter including a second operational amplifier having a grounded plus-input, a minus-input connected to the output of said first operational amplifier and an output connected to its minus-input, and said d.c. voltage-to-a.c. voltage changer including a second electronic two-position switch having one contact connected to the output of said second operational amplifier and another contact connected to the output of said first operational amplifier.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
Draw. Desc | Image

Generate Collection | Print

Terms	Documents
L8 and reference ADJ voltage and counter and rectifier and (input or output)	2

Display Format: KWIC Change Format

Previous Page Next Page